

PRELIMINARY DATA REGARDING THE DISTRIBUTION OF THE SPECIES *SEDUM ANNUUM* L (CRASSULACEAE) IN ROMANIAN SOUTHERN CARPATHIANS.

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Abstract: *Sedum annuum* L. is an annual species sometimes perennating by basal nonflowering shoots, with subsessile 5-merous flowers, with yellow petals and round-tipped, bright green glabrous leaves.

The species has a pan-European distribution, with a range limited by 55°W and 32°E meridians, reaching the northernmost regions of Europe in Norway and Iceland. The Romanian range covers the whole country, preponderantly in higher regions, the species occupying many habitats in stony places but having fairly large ecological amplitude. The region involved in our study spans North of Danube being limited approximately by the 46°N parallel to the North, comprising a wide variety of habitats from the Danube flood plains to the highest peaks in the Romanian Carpathian Mountains (an altitude ranging between 50-2550m a.s.l.), with a climate and edaphic conditions similarly diverse.

The present study presents a list of the locations from which the species *S. annuum* L was mentioned, complemented by the first grid map in UTM projection system of the species distribution in Romanian Southern Carpathians together with considerations about the chorology and the ecology of the species with reference to biotic and abiotic factors involved in its distribution.

Keywords: *Sedum annuum* L, *Crassulaceae*, chorology, Southern Carpathian Mountain range, Romania, distribution UTM grid map, UTM geocodes, ecology, phyto-coenology.

Introduction

To this date there is no botanical work describing the complete distribution range of *Sedum annuum* L. in Southern Carpathian mountain chain. Moreover, despite the relative richness of habitats and conditions for a diversified *Sedum* flora, no monograph on the genus *Sedum* from Romania was issued until now, while the only monographic treatment of this genus in Romanian flora has been published half a century ago.

Our study is a first attempt to fill at least part of this knowledge gap by providing data about the distribution *S. annuum* L in the Southern Carpathian range.

Background

Sedum annuum L is a usually annual species but sometimes perennating through "sterile" densely foliated shoots. Morphologically characterized by 5-merous shortly-pedicelated flowers with yellow petals, *Sedum annuum* L is a very polymorphic species, displaying a wide variation in many characters as: number of ramifications, shoot length, size and shape of inflorescence and floral parts, and floral morphology in general. Typically it has fibrous roots, erect, simple or basally branched, 5-20cm tall, sometimes rooting stems, alternate, bright green semiterete, oblong-elliptic, cca. 5mm long, obtuse or rounded leaves with a short, whitish basal spur. Inflorescence cyme 1-3-branched, lax, having 5-25 shortly pedicelated flowers. Kalix with green obtuse/rounded of unequal length sepals, corolla with elliptic-lanceolate yellow cca 4mm long petals twice as long as the sepals, sometimes rubicund. Follicles are brown, patent, and allated

(each having conspicuous but small lips along the suture). Seeds are reticulate, or reticulose-papillate, with short papillae.

Despite its polymorphism which is mainly environmentally triggered [12], taxonomically *Sedum annuum* L constitutes a well-defined species.

Taxonomically, described by Linne in 1753, *Sedum annuum* is a pretty well circumscribed species having a perrenating form which was described by Murbeck in 1892 under *S. annuum* var. *perdurans*. Our observations in the field and in cultivated populations showed usual occurrence of perrenating individuals amongst annual ones, independent of site, thus warranting at most the “form” ranking as previously stated by t’Hart [12]

Răvăruț, the taxonomist of the genus in Romania [19] treated in the monumental work Flora RPR *S. annuum* var. *perdurans*. as a form of *Sedum annuum* L .

Flora Europaea [21], presents in a note below *S. annuum*, the perrenating form under *S. annuum* var. *perdurans* (*S. zollikoferi*) as a “perrenial variant of *Sedum annuum* L. occurring sporadically in populations in Balkan peninsula and the Carpathians”.

At present, Atlas Florae Europaeae [21] does not segregate *Sedum annuum* L from *S. annuum* var. *perdurans* Murb, treating them together as synonyms.

From an ecological point of view, *Sedum annuum* L typically is a calcifugous saxicolous arctic-alpine species, usually preferring sunny locations, xeric but not very dry alpine pastures with calcium-poor substrates, over well-drained bedrock, although it shows considerable ecological amplitude.

According to Lippert [15], *Sedum annuum* L has a fragmented distribution, up to fairly densely in certain locations, on rocks, gravel, stonewalls, dams, roadsides, but also in stony, open forests, on moderately dry, often humouse soils. In Italy, it is found on (siliceous) rocks and on walls.

Its reported altitudinal range in Southern/Central Europe spans above 700m *s.m.* (200 in Italy) but we have found it in Romania at lower altitudes (Svinita 100m.s.m.).

In Italy it occurs between 200-2780 m, in Southern Alps around 200-300m, in Tirol at 2100, Punschlav at 2780m. a.s.l. Wallis at 2800m.

In Romania it is spread throughout the country, occurring cf. *Atlas Florae Europae* [13], over the entire Carpathian chain. According to our observations, in Romania, *Sedum annuum* L, thrives in many habitats showing some ecological amplitude.

From a phyto-geographical and chorological point of view, *Sedum annuum* L is regarded by t’Hart [12] and Rechinger as an arctic-alpine Eurasian element, occurring from western Alps eastwards to the Caucasus, with a European range spanning between 55°W and 32°E meridians. As it occupies mainly mountainous habitats, its areal is largely disjunct, with a marked absence between 50° and 55° parallels, reappearing in arctic regions of Europe, Iceland Groenland and NE. Canada.

Coenologically, *S. annuum* L. is a characteristic species for Sedo-Scleranthion.

The objective of this study was to provide a preliminary overall image of the actual distribution of *Sedum annuum* L in the Southern Carpathians. This picture, although still incomplete, will help scholars studying this species to better understand the biological, ecological and chorological features of this taxon. This study will also form the basis of a complete distribution map of *Sedum annuum* L in Romania.

The region involved in our study extends North of Danube being limited approximately by the 44°N to the South and by 46°N parallel to the north; and spanning between 21° E meridian to the West and 27° E meridian towards East. It comprises the mountains situated approximately between km 4900-5100N of the UTM projection zones 34 and 35.

The studied region comprises a wide variety of habitats from the Danube to the highest peaks in the Romanian Carpathian Mountains (an altitude ranging between 50-2550m a.s.l.).

The climate is extreme continental characterized by wide annual and diurnal variations in temperature and rainfall, the region showing also similarly diverse ground cover and edaphic conditions.

With a composite flora, including balcanic, alpine, arctic-alpine, but also oromediterranean elements, together with a number of endemic taxa, the Southern Carpathian Mountains are a very interesting and challenging floristic entity. Together with the Balkans, the Carpathians might have very well been a speciation center in *Sedum*, as t'Hart work [12] suggests.

Our study presents a distribution list of the localities from which *Sedum annuum* L was mentioned, complemented by the first raster map in the UTM projection system of this species' distribution in Southern Carpathian Mountains together with some considerations about the chorology and ecology of the species with regard to biotic and abiotic factors influencing this distribution.

Method

At this stage we have comprised under *Sedum annuum* L all the citations that were not obviously erroneous, including the ones under *S. annuum* var *perdurans* Murr leaving for a later moment the task to ascertain beyond any doubt the assignment of these cited plant specimens or populations to *Sedum annuum* L or to some other related taxa.

We have also checked herbarium material from several very important herbaria in: Bucharest (-BUCA, BUAG, BUC), Cluj (-CL), Iași (-I), Vienna (-W, WU), Montpellier (-MPU), München (-M, MSB), Prague (-PRC), and incorporated data gathered there where applicable, along with data from fieldwork and personal collections of the authors.

The wide altitudinal variation (50-2500m) of the area didn't allow us to use for our study the altitude as a defining criterion for the analyzed region but rather its geographical boundaries.

To establish the UTM geocodes for the locations cited we have used when applicable Lehrer's work [14] about the cartography of Romanian fauna and flora using arealographic coordinates or geocodes derived from GPS coordinate readings from surveys done by the authors. The UTM geocodes were given when possible for the closest human settlement available.

For the cases when the citations were too ambiguous or couldn't be precisely located, we have only indicated the UTM 100km-quadrants geocodes. For each location cited we have mentioned when available; altitudes, citation sources and the name under which the plants were cited by each author where it differed from the accepted species name. Because of the limited space available and because this was not the objective of the present study, we do not give in this report data like collection dates, ecological and phytosociological information which will form the object of a future article.

Results

Our results comprise a number of 60 mentions of *Sedum annuum* L locations. Out of these, 11 sites were reported before 1957 (all from herbarium material), a number of 42 are reports published by other scholars until now, and a number of 7 are new locations or older locations in which the presence of *Sedum annuum* L was positively confirmed by us.

Some of the sites were impossible to assign definite UTM coordinates set, usually due to imprecise or insufficient data available. These sites were either discarded until further clarification, or were only mentioned in the table without placement on the map. The locations were sorted by county and by UTM geocode. The data are presented below in tabular format (see table 1).

Table 1: Location list from where <i>Sedum annuum</i> L was mentioned			
County	Location and Altitude (<i>m. s. m.</i>)	UTM Geocode*	Information Source**
AG	Mt. Păltiniș, Dealu Vinăt	LL	BUCA75118
BV	Schuler Siebenburgen, 15.08.1895, E.R. Missbach leg wird dem ?? Joseph Paul ??	LL84	PRC #na
BV	Mt Postăvaru, on “Drumu Șerpilor”,	LL84	(N05)
BZ	Mt. Siriu, pe Valea Neagră, leg Dihoru, 21.06.1957	ML34	BUCA147644
CS	In alpe Țarcu in Groapa sub cacumine, leg Al. Borza, I Todor, 25.07.1942		CL215810
CS	Herb Gen I. Schneider Herkulesbad.	FQ17	W1947-3256
CS	In rupas Krisus? Ad Thermes Herculis. Com Krassi Leg L. Thaisz, 23.06.1905	FQ17	CL110691
CS	Svinița	EQ 82	N04
CS	In pratis montanis Plugova, supra pagum Globureu, leg E. Nyarady, 22.06.1930	FQ 08	CL196701
CS	Mehadia	FQ07	[4]
DB	“upper stream of Damobovita” -Cheile Dâmbovicioarei	LL52	[1]
DB	sub <i>Sedum bologniense</i> Lois, Rumaeninen, Piatra nămăeștilor, Câmpulung, 1897, leg Loitlersberger	LL52	W1904-2033
GJ	Mții. Parâng, on “Badea”, leg Vicol E., 06.09.1961	FR91	CL621069
GJ	Parâng, leg Knapp	FR91	CL43745,
MH	Mehedinți Mts, between V Țesnei and Balta Cerbului	FQ18	N02
MH	V. Bahnei, leg N. Roman 16.05.1967	FQ	BUCA134519
MH	Montis Oslea, supra pagum Tismana, leg Nyarady 24.07.1928	FQ33	CL156711
PH	An Felsen bei Malajester Schutzhutte Bucegiu, Siebenburgen 18.07.1908, leg Dr. Walaczek,	LL82	W1926-20277
PH	Bucegi, Coștila, above Valea Alba, leg P. Cretzoiu 25.07.1944,	LL82	BUAG6537
PH	Bucegi, Jepii Mari, leg Nyarady 10.08.1929	LL82	CL196700, 05
PH	Ciucaș, Pasul Bratocea	ML13	N05
PH	Pârâul Berii, leg. M. Pușcaș, G. Coldea	ML13	CL656698
PH	Piatra Arsa-Sinaia leg Procopeanu., 07.07.1886	LL82	CL48465
PH	Sinaia, Piatra Arsă BUAG21502 , leg Grințescu, 1.07, CL48465 , leg. Procopeanu 07.07.1886, CL196700 , leg.E. Nyarady 10.08.1929	LL82	BUAG21502 , CL48465, CL196700
PH	Hab. in montibus Bucegi, Poiana Stena regală <i>solo calcareo, cca 1250m.sm. leg Krajina no3571 08.07.1931</i> (in PRC Herb. K Domin et V Krajina: Iter Romanicum 1931 No565)	LL82	PRC #na
PH	V. Furnica, leg ? 05.07.1911	LL82	I-5846
PH	Bucegi:	LL	
PH	Sinaia, leg Dihoru.,06.1955	LL 81/82	BUCA147649 N05
PH	Poiana Țapului, leg P. Bănărescu .07.1939	LL 82	BUCA145845
PH	Mizil Dl. Ciortea, E of Tataru village 08.06.1961	MK 49?	BUC317319
SB	Cristian	KL67	[11]
SB	Dl. Bucsa		[11]
SB	Dl. Caprei		[11]
SB	Dl. Derjan		[11]
SB	Dl. Grosu		[11]
SB	Jgheabul Văros		[11]
SB	Măgura Cislădioarei	KL76	[11]
SB	Masa Verde		[11]
SB	Mt. Ghihan		[11]
SB	Mt. Pleșu		[11]
SB	Pasul Dus		[11]
SB	Sibiu	KL77/87	[11]
SB	V. Balea	KL	[11]

SB	V. Doamnei	KL	[11]
SB	<i>sub sedum rupestre</i> Bmg. non L. <i>In rupibus et muris vetustis Transilvan.</i> Arpaş, leg Dr. Schur	KL	W #na
SB	V. Mogheşului	KL	[11]
SB	V. Râuşorul	KL	[11]
SB	V. Sadului	KL	[11]
SB	Vf. Barcaci	KL	[11]
SB	Vf. Negovanu Mare	KL	[11]
SB	“Valare“ Valari, leg K.Ungar 18.07.1921	FR 36?	BUCA43856* [11]
SB	Trans. Distr.Sibiu Ad saxa reg. subalpinae “ Valare”altcca 1300msm. 18 Jul 1921 leg. det. Ungar	FR36?	W1940-24077
SB	Fântânele	GR 27	[11]
SB	Gura Râului	GR 36	[11]
SB	Orlat	GR 36/37	[11]
SB	Râu Sadului	KL 75	[11]
SB	Cisnădioara	KL 76	[11]
SB	Sadu 1944,	KL 76/86	BUCA75119 , [11]
SB	-In rupibus Zibins Klamm (Creasta Cibinului), leg. J. Barth., 04.08.1908	KL 77/87	CL110693
SB	Sub f. <i>perdurans</i> Sibiu on walls	KL 77/87	[19], [11]
SB	Tălmăcel	KL 85	[11]
SB	Turnu Roşu	KL 85	[11]
SB	Tălmăciu	KL 85/86	[11]
SB	Cheile Cibinului	KL65	[11]
SB	Bistra	KL66	[11]
SB	Glăjăria Cârţişoarei	LK16	[11]
SB	Sub f. <i>perdurans</i> Cristian, by the church	LL 85	[19], [11]
TM	Valea Nădragului, above Crivina, leg Vicol E., 15.06.69	ER85	CL652316
VL	NE of Zmeurătu, leg N. Roman 11.07.1961	KL 70	BUCA144054
VL	At the base of the Cozia rocks, leg E.I. Nyarady, 20.06.1950	KL91	BUCA73995 BUCA7399
VL	Turnu Monastery	KL91	N02,B02
<p>*The UTM geocodes were given when possible for the closest human settlement available, and when the locations couldn't be precisely located, we have only indicated the UTM 100km-quadrants geocodes. **For the information source see the reference list. New locations or older locations in which we positively confirmed the presence of <i>Sedum annuum</i> L. are highlighted. In several sites specimens were found in subsequent years, which were equally mentioned for reference. From these sites, specimens were either photographed, or collected and stored dried or preserved in ethanol in authors' collections. (BN + XX) = (Barca & Niculae + the last 2 digits of the year when the plant was found <i>in situ</i>) e.g. (BN 04) = (Barca & Niculae 2004) (B + XX) = (Barca + the last 2 digits of the year when the plant was found <i>in situ</i>) (N + XX) = (Niculae + the last 2 digits of the year when the plant was found <i>in situ</i>) W#### = Herbarium acronym (according to: Holmgren, et al. 1998) and sheet number of the herbarium sheets bearing the cited specimen; #na = Sheet number non available at the time of herbarium visit</p>			

The sites that were clearly located on the map are presented in figure 1, in which the map was divided by UTM quadrants in a more convenient format. We have indicated the sites cited using different symbols for the 3 data subsets, of which the most important is the subset comprising the sites in which the presence of the species was positively confirmed by us. The other two subsets comprise the literature data that were divided using the monographic work of Răvăruş as milestone, as follows in figure 1.

Conclusions

This study reports findings of both literature and herbarium material surveys and previously unpublished data from personal fieldwork of the authors.

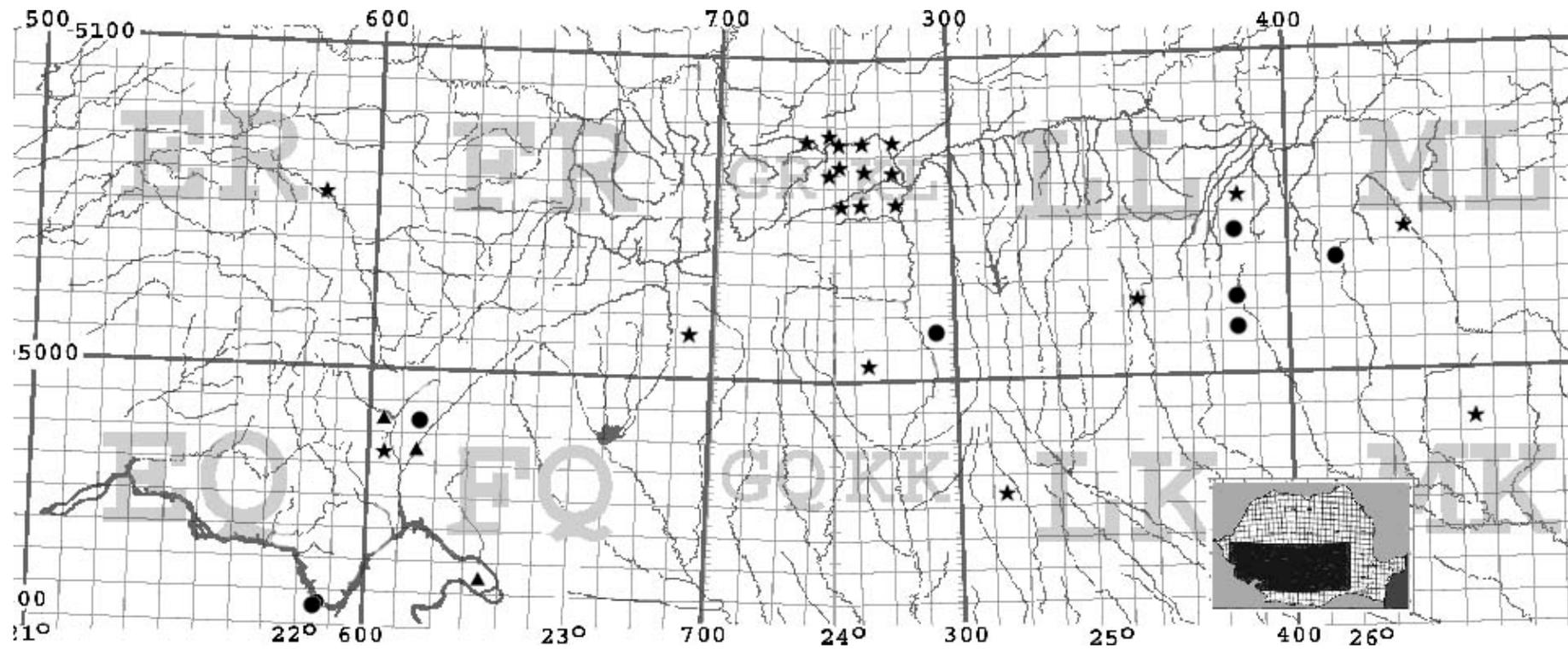


Fig 1: Distribution map in UTM projection system of the sites where *Sedum annuum* L. was positively identified. ▲ designates sites cited before 1957, ★ designates sites cited after 1957 by other authors and ● designates new sites or older sites in which we positively confirmed the presence of *Sedum annuum* L.

Our preliminary results indicate that, like in *S. hispanicum* L [17], the range occupied by *S. annuum* L is probably larger than previously believed. We believe that potential problems in establishing a correct distribution range of *Sedum annuum* L Romania are the facts it was sometimes confounded with *S. acre* L. and thus wrongly cited, and also that it probably was under-reported by previous authors, its occurrence being probably considered unworthy of mentioning from all locations where it was found.

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DATE PRELIMINARE PRIVIND RĂSPÂNDIREA SPECIEI *SEDUM ANNUM* L (*CRASSULACEAE*) ÎN CARPAȚII MERIDIONALI DIN ROMÂNIA

(Rezumat)

Sedum annuum L. este o specie anuală care supraviețuiește uneori prin lăstari sterili, cu flori subsesile 5-mere, cu petale galbene și frunze glabre, de culoare verde aprins.

Specia are răspândire pan-europeană, cu un areal mărginit de meridianele 55°W și 32°E, dar atinge și cele mai nordice regiuni ale Europei în Norvegia și Islanda. Arealul românesc cuprinde întreaga țară, preponderent în regiunile înalte, specia ocupând multe habitate în zone stâncoase dar având o amplitudine ecologică destul de mare.

Zona luată în studiu se întinde la N de Dunăre fiind limitată la N de paralela 46 și cuprinde biotopuri variate de la Câmpia Dunării până la vârfurile cele mai înalte din Carpații Românești, cu o climă și pedologie de asemenea foarte variate.

Studiul nostru prezintă o listă a localităților din care a fost menționată specia *S. annuum* L, precum și o hartă raster în sistemul UTM a răspândirii speciei în Carpații Meridionali împreună cu unele considerații privind corologia și ecologia speciei, cu referire la factori biotici și abiotici implicați în răspândirea ei.